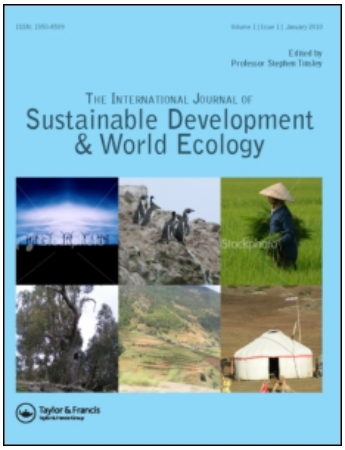

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Comparative analysis using EIA for developed and developing countries: case studies of hydroelectric power plants in Pakistan, Norway and Sweden

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Comparative analysis using EIA for developed and developing countries: case studies of hydroelectric power plants in Pakistan, Norway and Sweden

Abdul-Sattar Nizami[a]*, Sverker Molander[b], Zaki-ul-Zaman Asam[c], Rashid Rafique[a], Nicholas E. Korres[a], Gerard Kiely[a] and Jerry D. Murphy[a]

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Environmental impact assessment (EIA) is an important legislative and scientific tool that may assist and improve the quality assistance for the decision-making process in sustainable development. Here, a comparison of EIAs from three cases of hydropower projects in Pakistan, Norway and Sweden is reported. A huge difference concerning the incorporation of environmental considerations into the decision-making process between developed and developing countries is observed. The EIA system of Pakistan appears to be less efficient in the application and review process. In addition, the appraisal of issues, the decision-making process and evaluation through post-monitoring is not as well performed in Pakistan as in cases of hydroelectric power plants in Sweden and Norway. The key reason for this shortcoming is misconceptions about the EIA process, which initially receives intense attention but becomes weakened by the time of implementation. This implies that there is a need to adopt simplified and flexible EIA techniques suitable for the infrastructure and resources of a specific country, taking into account institutional, technical and financial constraints. Improvements are required in public participation, awareness, as well as in environmental control and data system sectors in Pakistan, besides simply enacting legislation to achieve the goals of the EIA system.

Keywords: environmental impact assessment; decision-making process; sustainable development

Introduction

Societal economic development and the environment can no longer be considered two unconnected concepts due to an increased human influence on the environment. This was highlighted in the Brundtland report (WCED 1987) by the World Commission on Environment and Development. In the report, efforts were made to integrate environmental aspects with developmental issues and the concept of sustainable development (SD) was given much weight (Bruhn-Tysk and Eklund 2002). However, before the introduction of SD, the environmental impact assessment (EIA) was introduced at national and international levels during the 1970s and 1980s as a new legislative and technical tool to address the perceived conflicting interests of environment and development (Wood 2003). Acknowledging that the progress in the economic development, which had started without depleting and harming the natural resources and the natural environment respectively, had now reached a level where appropriate legal instruments were needed (Bleicher and Gross 2010).

EIA of hydroelectric power plants is important due to the problems associated with hydropower production, which accentuate the trade-off between societal development and environmental protection (Giuliani and Gurnari 1996). The development of hydroelectric power plants not only involves ecological risks due to intensive exploitation of rivers and streams (Battistel and Pontalti 1996), but also the need to inform the public and increase awareness; a need that is always emphasised (Mura 1996).

EIA systems are important legislative and scientific tools that potentially improve the quality of the decision-making process for sustainable development. EIA was introduced in the USA in 1969 and was implemented in EU member states in 1985 through a European Community Directive (85/337/EEC) (EEC Council Directive 1985, 1997, 2003). Initially, EIA was primarily confined to developed countries, but has become progressively more familiar in developing countries. There are differences between EIA systems implemented in developed and developing countries (Table 1; Wood 2003), but even within a cluster of countries with similar socio-economic, cultural and environmental attitudes. Additionally, EIA varies in its origin and effectiveness even between countries in close vicinity (Wood 2003). For instance, in Somalia EIA is considered insignificant, while in Ghana it is of increasing significance (Appiah-Opoku 2001). Briffett (1999) recognised these differences at a minor scale saying, 'there are considerable variations in the EIA system used particularly in relation to the scope, scale and content,' and George (2000) identified EIA on a broader scale as 'resources and administrative systems, social and cultural systems, and the level and nature of economic development.' This study is an analysis of the EIA system guidelines and how they are implemented in practice in two developed

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Table 1. EIA in developed and developing countries (Wood 2003).

EIA system	Developed countries	Developing countries
Legal provision	Comprehensive and specific legal provisions for clear definition of EIA	A clearly defined EIA process is rare in legislation and is mostly incorporated into other decision-making procedures
Assessment of environmental impacts	Thorough assessment of environmental impacts	Mainly considered only in significant projects. Cumulative and direct impacts are not assessed
Alternative actions	Demonstration of alternative actions	Alternatives often not considered
Screening	Complete screening for actions of environmental significance	Lists of activities, thresholds and criteria for screening
Scope	Specific guidelines for public participation ensured	Public participation is rare
Report content	Requirements present in EIA reports, along with guidance for quality control	System reports are planned according to demands of development assistance agencies
Public participation	Reports reviewed publicly and proponents reply to questions raised	Public often not involved. Proponents rarely respond to points raised to improve and review the report
Review	For decisions on action, findings reports and reviews are considered	Influence is theoretical, not practical
Monitoring	Monitoring of impacts of actions is linked to early stages of process	Monitoring is rare and carried out for specific requirements
Mitigation	Mitigation plans for each stage are considered	Mitigation considered fully but implementation is inadequate
Consultation	Consultation and public participation before publication of reports	Formal requirements for consultation and public participation are almost non-existent
System monitoring	Evaluation through real life data and observation	Monitoring is absent but agencies and prior experience can modify procedures
Finance and time requirements	These are accepted by developers	These are not accepted for a specific time frame
Strategic environmental assessment	Applied to programmes, plans, policies and projects	In some countries is applied by development assistance agencies

and one developing country – Norway, Sweden and Pakistan.

Sweden and Pakistan are discussed as case countries for the evaluation of EIA system guidelines, while the EIA system post-implementation is analysed using one hydro-electric power plant in each of the countries (i.e. Sweden, Pakistan and Norway). The objective of the paper is to discuss the reasons behind the shortcomings of the EIA system in Pakistan and to suggest possible solutions to remove inadequacies.

EIA in Sweden, Norway and Pakistan

The Swedish Environmental Protection Agency (SEPA) described the requirements for EIA, which became part of the Environmental Protection Act in 1981 (Modak and Biswas 1999). EIA legislation was enacted in 1987 in the Road Act (Bjarnadottir 2001) and Management of Natural Resources Act (Bruhn-Tysk and Eklund 2002), which were strengthened in the Environmental Assessment Ordinance of 1991. The content of an environmental impact statement (EIS) was described in new guidelines set by SEPA in 1995. The significant and potential of EIAs in Sweden improved due to exchange of experience and comparisons of EIA research in a trans-boundary context in the early 1990s by the Nordic Council ad hoc group (Lerman 2004). Compulsory EIA for projects became law in 1994, when the European Economic Space (EES) Agreement was signed. EIA in its present context is part of the new environmental code that came into force on 1 January 1999 (Englund and Styrke 2001). The EIA system in Norway was also instituted in the same European Union directive as that in Sweden. Both countries use EIA systems that have much in common due to similar socio-economic and socio-political infrastructure (Tesli and Husby 1999; Bjarnadottir 2001).

In Pakistan, EIA was introduced in 1983 through Pakistan Environmental Protection Ordinance (PEPO), as requirement during the planning of a project. PEPO also motivated enactment of the EIA process in the country (PEPA 1997a), which became mandatory for public and private projects on 1 July 1994 when general guidelines for the EIA process were prepared. EIA legislation was included in the Pakistan Environmental Protection Act (PEPA) 1997, replacing the PEOP 1983 (PEPA 1997b). EIA gained a firm legal state in 2000, in the EIA/Initial Environmental Examination (IEE) regulations, which included sectoral and general guidelines (PEPA 2000). EIA became compulsory on 27 July 2004 after the decision of Executive Committee of the National

Economic Council (ECNEC) that an EIA report must be submitted along with other documents (e.g. project documents). The National Environmental Policy described EIA implementation at project level to integrate the environment into development planning and promotion of strategic environmental assessment (SEA) in 2005 (PEPA 2005). Ineffective natural resource management over many years and a long history of unplanned development not only have had negative impacts on Pakistan's socio-economic fabric but also on its environment, particularly in urban areas (Nadeem and Hameed 2008).

Methods

Criteria for evaluation of EIA guidelines in Sweden and Pakistan

EIA guidelines in Sweden and Pakistan are compared and reviewed on the basis of criteria suggested by Fuller (1999; Table 2). These evolved from the work of Ortolano et al. (1987) and Wood (1999), who characterised criteria based on a so called 'systemic' and 'foundation' classification of EIA systems. Ahmad and Wood (2002) have further revised the criteria, which were also used by El-Fdel and El-Fadl (2004) to compare the efficiency of EIA in Middle East and North African (MENA) countries. As Fuller (1999) stated, 'systemic measures are designed to deliver quality assurance in the practice and administration of EIA, whereas foundation measures promote good practice and underpin the successful application of the systemic approaches'. A multi-criteria evaluation (MCE) scheme (Table 3) was used for comparisons of EIA guidelines between the two countries. This was constructed after selection of a sub-set of systemic and foundation measures (Table 2), which were similar for both countries. Zero was assigned when a criterion was not applied and one when it was implemented. Additionally, responses were weighted according to a hierarchy such that a response at a higher level was assigned a higher weighting. For example, the response to 'enabling legislation and executive regulations/decree' under EIA legislation was given a weight of 5, whereas the response to 'draft regulation/decree' was assigned a weight equal to 1.

Criteria for evaluation of EIA post-implementation in Norway, Sweden and Pakistan

Post-implementation analysis of EIA systems among Pakistan, Sweden and Norway was based on an additional MCE scheme consisting of five criteria, with a weighting score from 0 to 3 (Table 4). The highest weight (3) was assigned in cases where each of the three steps under each criterion was covered. For example, if only two steps in 'EIA studies' were covered a weight of 2 was assigned, if none then 0, whereas if all steps were fulfilled then 3 was assigned.

Cases of hydroelectric power plants with and without EIAs in Sweden, Norway and Pakistan

The case of hydroelectric power plants is discussed in two different types of comparisons. The first regards two cases

Table 2. EIA evaluation criteria: systemic and foundation measures (Fuller 1999).

Systemic measures	EIA legislation	• Legal provisions • Provisions for appeal by developer or public • Legal or procedural specification of time limits • Formal provision for SEA
	EIA administration	• Competent authority and determination of acceptability • Review body • Specification of sectoral responsibilities • Level of coordination with other planning and pollution control bodies
	EIA process	• Specifies screening categories • Systematic screening approach • Systematic scoping approach • Requirement to consider alternatives • Specified EIA report content • Systematic EIA report review • Public participation in EIA process • Systematic decision-making approaches • Requirement for management plans • Requirement for mitigation of impacts • Requirement for impact monitoring • Experiences in SEA
Foundation measures	• General and/or specific guidelines, including sectoral authority procedures • System implementation and monitoring • Expertise (universities, institutes, consultancies with technical expertise) • Training and capacity building	

Table 3. Weighting scores for EIA system guidelines.

Criterion	Response	Weight	Justification
EIA legislation	Enabling and executive regulations or decrees	5	Five levels of legislation
	Enabling and draft executive regulations or decrees	4	
	Enabling	3	
	Draft and regulations or decrees	2	
	Draft regulations or decrees	1	
Coordination with planning and pollution control bodies	High	3	Three levels of coordination
	Moderate	2	
	Weak	1	
	None	0	
Screening categories	Three categories	3	Four levels of screening
	Two categories	2	
	One category	1	
	None or not performed	0	
Screening approach	Threshold/lists or applications for licenses	1	One point per appropriate screening method
Scoping	Discretionary or not performed	0	Responsible authority provides a more consistent scope based on formal requirements than proponents
	Responsible authority	2	
	Proponent	1	
	No systematic approach or not applied	0	

Table 4. Weighting score scheme for the EIA system post-implementation.

Criterion	Steps in measurement	Weight	Justification
EIA studies	Screening Scoping Public participation	0–3	A weight of 3 was assigned in each of the three steps for each criterion. A weight of 2 was assigned where two steps were covered. Zero was assigned when none of the steps were fulfilled
Unsolved issues	Social Economic Environmental	0–3	
Loss to humans and environment	Human Flora Fauna	0–3	
Success of mitigation measures	Displaced people Flora Fauna	0–3	
Administrative timetable	Delays	0–1	Only two options: yes or no. If delay then 0, no delay 1 point

of hydroelectric plants (the Suorva hydroelectric power plant in Sweden and the Tarbela hydroelectric power plant in Pakistan), for which no EIA study was performed. In the second comparison, two cases of hydroelectric power plants (the Aurland hydroelectric power plant in Norway and Ghazi Barotha hydroelectric power plant in Pakistan) are compared, for which EIA studies were conducted. Hence two clusters were formed: two without and two with EIAs, two in developed countries and two in Pakistan.

Tarbela hydroelectric power plant

Tarbela, being the world's largest earth-fill dam, is a national aspiration for Pakistan. The dam is in the North-West Frontier Province (NWFP), in the Indus River system, whose catchment area is 944,600 km^2. Construction works started in 1968; the first storage of water was in operation in 1975, and power generation commenced in April 1977. Today, the dam actively produces annually 14.9 TWh (WAPDA 2011) of electricity, that is, 22% of the national energy requirement. The dam is 485 ft high, having two spillways and four tunnels. At the time of implementation and construction, the constitutional requirements for an EIA were not enforceable, so no EIA study was conducted for this project (AADI 2000).

Suorva hydroelectric power plant

The Suorva dam with the Porjus hydroelectric power plant is located upstream in the Stora Luleälv River in northern Sweden. The Porjus power station has an installed capacity of 440 MW and an annual production of 1.2 TWh. The entire river system contains 15 power plants that include 29 turbines. The reservoir of the Suorva dam is

the second largest artificial reservoir in Sweden designed for hydropower production. The first impoundment was completed in 1919 by the State Power Board. In 1920 the plant started to electrify surrounding villages, a radio station and local airports. At the time of development in early 1919, the EIA regulations were not implemented; therefore, the project was started without an EIA (Hammar and Ljungqvist 2000).

Ghazi Barotha hydroelectric power plant

The Ghazi Barotha power plant, completed in 2003, is on the Indus River in northwest Pakistan. The annual power generation is around 6.6 TWh, which is about 10% of Pakistan's current energy requirement. The project consists of three segments: barrage, power channel and power complex. The barrage is 7 km downstream of Tarbela dam, the channel is 52 km long and the power complex has a total generating capacity of 1.45 GW. Guidelines and regulations for the development were set by the World Bank, similar to those of the Asian Development Bank (ADB). Due to enactment of the Environmental Protection Act, EIA studies were conducted (WAPDA 2000; ADB 2005).

Aurland hydroelectric power plant

The Aurland hydroelectric power plant is located in the Aurland valley in western Norway. The dam was planned between 1960 and 1969 and construction continued from 1969 to 1984. The plant was finally commissioned and commenced operation in 1984. The Aurland plant consists of five power plants with a current capacity of 0.84 GW and an annual production of 2.0 TWh. In 1992, it provided 30% of electricity for Oslo, Norway's capital. Recently, the addition of a third unit has increased total capacity to 1.1 GW. For approval of construction, there were extensive EIA studies (IEA 2005).

Analysis of EIA guidelines of Sweden and Pakistan

The EIA guidelines were limited, in terms of available official reports and documents. Both Sweden and Pakistan were credited a score of 5 (Table 5) for legal provisions because they have EIA legislation and executive regulations for EIA (Table 6). Pakistan's EIA guidelines scored slightly better than the Swedish guidelines due to the possibility of appealing decisions (Table 5); the decision on an EIS made by a competent authority cannot be appealed in Sweden (Table 6). No relevant information was available on coordination and environmental management plans (EMPs) in the legal and administrative documents. Two screening methods are available in these countries, so each was credited two points. There are no monitoring requirements in the Swedish Environmental Code but in other ordinances, such as on supervision, inspection, enforcement and self-monitoring, there are provisions for monitoring. Besides this, the specifications for all other criteria are fulfilled by Sweden and Pakistan (Table 6). The similarities between Pakistani and Swedish EIA guidelines support the observations of Briffett (1999), Sankoh (1996), Wandesforde-Smith et al. (1985) and Wood (2003) that the EIA system of developing countries is based on a Western model. As Ebisemiju (1993) stated, in the developing countries, EIA systems consist of impressive processes that cannot be practically implemented. However, Ahmad and Wood (2002), Paliwal (2006) and Zubair (2001) considered that the regulations and guidelines for EIA preparation, review and public consultation in Pakistan are comprehensive and can possibly be compared with those of Egypt, Tunisia, India and Sri Lanka (Nadeem and Hameed 2008).

Table 5. Results of criteria for EIA guidelines for Sweden and Pakistan.

Criteria	Sweden	Pakistan
Legal provisions	5	5
Appeals	0	1
Time limits	1	1
Competent authority	1	1
Review body	1	1
Sectoral authorities	1	1
Coordination	NA	NA
Screening categories	2	2
Screening approach	1	1
Scoping approach	1	1
Alternatives	1	1
Report content	1	1
Report review	1	1
Public participation	1	1
Decision-making	1	1
Environment management plans (EMPs)	NA	NA
Mitigation	1	1
Monitoring requirements	1	1
Total	20	21

Analysis of the EIA system post-implementation in Sweden, Norway and Pakistan

Both Suorva and Tarbela dams had potential environmental impacts on humans, flora and fauna, and left unsolved issues of displaced people. Only Sweden is Scored 1 for successful mitigation efforts to protect the existing flora (Table 7). The central differences between Aurland and Ghazi Barotha power plants were the unresolved issues and problems of displaced people (Table 8), which were noted in the presence of well-planned programme for effectees in Pakistan. There were unusual delays from beginning to completion of Ghazi Barotha because of financial constraints and labour disputes. Nadeem and Hameed (2008) found financial inadequacies were responsible for the delays and problems in coordination of the EIA. Additionally, such problems occur when there is a lack of administrative competency in developing countries, ignoring social and cultural needs and sensitivities of displaced peoples (Huang et al. 2008). For example, in Bali and Chiang Mai, spiritual and religious values were totally

Table 6. Comparison of EIA system guidelines in Sweden and Pakistan (PEPA 1997a, 1997b, 2000, 2005; Modak and Biswas 1999; Bjarnadottir 2001; Englund and Styrke 2001; Bruhn-Tysk and Eklund 2002; Lerman 2004).

	Sweden	Pakistan
EIA legislation		
Initial legislation	Environmental Protection Act 1981	1983 Ordinance No. 37
Enabling legislation	Road Act 1987 (1971:948), Ordinance on EIS 1991 (1991:738)	Environmental Protection Act 1997
Current legislation	Environmental Code (1998:808), Chapter 6	National Environmental Policy 2005
Decree/regulation/order	Ordinance on Environmental Impact Statements (1998:905)	EIA/IEE regulations 2000
Other legislation or additional requirements	Planning and Building Act (1987:10), Chapter 5, Article 18	No information available
Status of regulations	Legislated	Legislated
Provisions for appeal	Present	Present
Specification of time limits	Present	Present
EIA process		
Screening	County administrative board	Federal and provincial EPAs
Scoping	Developer ensures consultation with authorities	Proponent consults with private consultants
Preparation of EIS	Developer	Proponent
Notification (making EIS official and available for comment)	County administrative boards	Federal and provincial EPAs
Review	County administrative boards	Federal and provincial EPAs
Decision-making	County administrative boards	Federal and provincial EPAs
Appeal regarding screening	No appeal	Present
Decision on development	Environmental court, superior or supreme court	Federal and provincial EPAs
Implementation of individual parts	NA	NA
Monitoring	Developer	Proponent
EIA administration		
Competent authority and environmental acceptability	Present	Present
Review body	Present	Present
Specification of sectoral authorities' responsibilities	Present	Present
Coordination with planning and pollution control bodies	NA	NA
EIA practice		
Specified screening categories	2	2
Systematic scoping approach	Threshold list	Threshold list
Systematic scoping approach	Developer	Proponent
Requirement to consider alternatives	Present	Present
Specified report content	Present	Present
Systematic report review	Present	Present
Public participation in process	Present	Present
Systematic decision-making	Present	Present
Requirement for mitigation of impacts	Present	Present
Requirement for impact monitoring	Present	Present
Foundation measures		
Existence of general and/or specific guidelines, sectoral authority procedures	Present	Present
System implementation monitoring	Present	Present

Table 7. Results of case studies without EIA studies in Sweden and Pakistan.

Criteria	Suorva dam	Tarbela dam
EIA studies	0	0
Unsolved issues	0	0
Losses to humans and environment	0	0
Success of mitigation measures	1	0
Administrative timetable	0	0
Total	**1**	**0**

Table 8. Results of case studies with EIA studies in Norway and Pakistan.

Criteria	Aurland power plant	Ghazi Barotha power plant
EIA studies	3	3
Unsolved issues	3	1
Losses to humans and environment	3	2
Success of mitigation measures	3	2
Administrative time table	1	0
Total	**13**	**8**

ignored during development of Tanah Lot. Countries like Indonesia and Malaysia are trying to establish a joint EIA systems but the resources are lacking for adherence and implementation (Briffett 1999). Table 7 shows the success of mitigation measures for the Suorva dam since no EIA system was enabled in Sweden and Pakistan at that time. Table 8 highlights the importance of EIA in Norway and Pakistan in reducing negative impacts to humans and the environment, success of mitigation measures and unresolved issues.

Conclusions and recommendations

The implementation of an EIA system in Pakistan is not in line with the guidelines because of financial and social constraints (Nadeem and Hameed 2008). Although comprehensive EIA guidelines have been enacted in Pakistan, the implementation, review, appraisal of issues, decision-making and evaluation through post-monitoring steps are not effectively considered in practical applications. These

Table 9. Existing problems of the EIA system in Pakistan, with recommendations.

Existing problems	Recommendations	Suggestions
Lack or no monitoring requirement during and after implementation	Environmental monitoring committee	• Committees should consist of representatives of responsible authority, proponent, government agencies or authority and NGOs • Success depends on periodic meetings and further public consultation. An authority should be placed next to the proponent and director general to provide adequate scientific advice on mitigation
Lack of effective environmental audit	Monitoring and management plan for risk and hazard identification	• Carried out through checklists, questionnaires or rating systems • Time-series data gathered so graphs can be analysed to provide significance of variations and rates and directions of change • Sufficient funds released for monitoring to identify and rectify environmental impacts, and save immediate costs at early stage • Design of monitoring programme should be based on careful consideration regarding time frame and applicability of results
Weak public participation and weak public hearing system	• Awareness • Training • Networking • Education	• Strengthen through the promotion of volunteerism • Effective and objective involvement in the process, increase involvement of various sectors • Judicial activism development for environment • Training and networking needed on sustainability and environment-related subjects in the curriculum
Effective implementation and enforcement mechanisms missing or unsatisfactory	• Strong political will • Necessary infrastructure • Participation of local government • Effective monitoring and evaluation	• Need for strong political will at all levels • Development of infrastructure to strengthen efficiency of the system • Participation of local governments and departments at lower levels • Effective implementation of system not possible without transparency and monitoring. Evaluation of programmes also needed • Sectoral guidelines for proper and effective implementation at all levels • Implementation capacity increased by provision for necessary monitoring equipment, trained manpower, logistics and transport

problems can be solved by making the EIA system simple and flexible, which not only suits the infrastructure and resources of Pakistan but also considers institutional, technical and financial constraints. Therefore, there is need for integrated efforts at all levels, that is, social, cultural, ethnic and heritage, to convert or amend development projects. The objectives of EIA are difficult to achieve unless associated sectors such as public participation, awareness, environmental control and data systems are improved to levels in developed countries. The existing problems of the EIA system in Pakistan in comparison to developed countries are shown in Table 9 together with some recommendations. Suggestions are also provided to facilitate the implementation of these recommendations.

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